

WHAT IS CLAIMED IS:

1. A liquid injection apparatus comprising:

an injection device including a liquid discharge nozzle, a first end of the liquid discharge nozzle being exposed to a liquid injection space, a piezoelectric/electrostrictive element which is activated by a piezoelectric-element drive signal that vibrates at a predetermined frequency, a chamber connected to a second end of the liquid discharge nozzle, a liquid feed path connected to the chamber, and a liquid inlet establishing communication between the liquid feed path and the exterior of the injection device;

a pressurizing device for pressurizing liquid;

a solenoid-operated on-off discharge valve including a solenoid-operated on-off valve which is driven by a solenoid valve on-off signal, and a discharge port which is opened and closed by the solenoid-operated on-off valve, the solenoid-operated on-off discharge valve receiving the liquid pressurized by the pressurizing device, and discharging the pressurized liquid into the liquid inlet of the injection device via the discharge port when the solenoid-operated on-off valve is driven to open the discharge port;

a pressure detection device for detecting liquid pressure at a certain location in a liquid path extending from the discharge port of the solenoid-operated on-off discharge valve to the first end of the liquid discharge nozzle exposed to the liquid injection space; and

an electrical control unit for sending the piezoelectric-element drive signal to the piezoelectric/electrostrictive element and the solenoid valve on-off signal to the solenoid-operated on-off discharge valve,

wherein the piezoelectric/electrostrictive element is driven in such a manner that the liquid discharged from the solenoid-operated on-off discharge valve is atomized and injected into the liquid injection space in the form of droplets from the liquid discharge nozzle, and

wherein the electrical control unit is configured in such a manner as to change the piezoelectric-element drive signal on the basis of the liquid pressure detected by the pressure detection device.

2. A liquid injection apparatus according to claim 1,  
wherein the pressure detection device is a piezoelectric element disposed in the liquid feed path, the liquid inlet, or the chamber.

3. A liquid injection apparatus according to claim 1,  
wherein the pressure detection device is a piezoresistance element disposed in the liquid feed path, the liquid inlet, or the chamber.

4. A liquid injection apparatus according to claim 1,  
wherein the pressure detection device is the  
piezoelectric/electrostrictive element of the injection device.

5. A liquid injection apparatus according to any one of claims 1 to 4,  
wherein the electrical control unit is configured in such a manner as to generate the piezoelectric-element drive signal so as to activate the piezoelectric/electrostrictive element when the liquid pressure detected by the pressure detection device is in the process of increasing or decreasing because of generation of the solenoid valve on-off signal or stoppage of

generation of the solenoid valve on-off signal, and in such a manner as not to generate the piezoelectric-element drive signal when the liquid pressure detected by the pressure detection device is a constant, low pressure because of disappearance of the solenoid valve on-off signal.

6. A liquid injection apparatus according to any one of claims 1 to 5, wherein the electrical control unit is configured in such a manner as not to generate the piezoelectric-element drive signal when the liquid pressure detected by the pressure detection device is equal to or higher than a high-pressure threshold.

7. A liquid injection apparatus according to any one of claims 1 to 4, wherein the electrical control unit is configured in such a manner as to continuously generate the piezoelectric-element drive signal, during a period in which the liquid pressure detected by the pressure detection device is higher than a low-pressure threshold because of generation of the solenoid valve on-off signal, and is configured in such a manner as to generate the solenoid valve on-off signal such that the pressure of liquid contained in the liquid feed path increases steeply immediately after start of generation of the solenoid valve on-off signal and subsequently decreases gradually at a pressure change rate whose absolute value is smaller than that of a pressure change rate at the time of the increase of the liquid pressure.

8. A liquid injection apparatus according to claim 7, wherein the electrical control unit is configured in such a manner as

to change the solenoid valve on-off signal on the basis of the liquid pressure detected by the pressure detection device.

9. A liquid injection apparatus according to any one of claims 1 to 8, wherein the electrical control unit is configured in such a manner as to change the frequency of the piezoelectric-element drive signal according to the liquid pressure detected by the pressure detection device.

10. A liquid injection apparatus according to any one of claims 1 to 9,

wherein the electrical control unit is configured in such a manner as to change the piezoelectric-element drive signal such that the frequency of the piezoelectric-element drive signal increases with an increase in the liquid pressure detected by the pressure detection device.

11. A liquid injection apparatus according to any one of claims 1 to 10,

wherein the electrical control unit is configured in such a manner as to change the piezoelectric-element drive signal such that the volume change quantity of the chamber reduces with an increase in the liquid pressure detected by the pressure detection device.